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ABSTRACT

Feedback procedures and information provided to instructors within computer managed learning environments were assessed to determine current usefulness and meaningfulness to users, and to present the design of a different instructor feedback instrument. Kaufman's system model was applied to accomplish the needs assessment phase of the study; and two sets of information were gathered: data from two questionnaires to 44 faculty members using computer managed instruction (CMI) strategies; and survey data from 115 institutions using CMI systems. Results led to the design of a feedback report to the instructor, structured by useful and relevant information content and coherent format. Training areas for instructors using feedback information from CMI systems were suggested, recommendations were given for the development of a CMI system user manual, and the importance of implementing appropriate feedback delivery mechanisms was emphasized. Relationships were also indicated between faculty members' characteristics and actual involvement with CMI learning environments. (Author/CMV)

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An Assessment of Feedback Procedures and Information Provided to Instructors Within Computer Managed Learning Environments - Implications for Instruction and Software Pedesign

by

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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An Assessment of Feedback Procedures and Information Provided to Instructors Within Computer Managed Learning Environments - Implications for Instruction and Software Redesign*

by Arturo A. Kotesky**

INTRODUCTION

It is easy to realize the tremendous impact produced by computers in modern society. Advanced educational systems have introduced the use of the digital computer to help accomplish their educational tasks. In fact, within the past 15 years, the usage of computers in education has progressed to a point where in 1972 nearly every university and more than one-third of the four-year colleges provided computer services for research and instructional purposes (Watson, 1972). Educational technologists in the early 1960s began to explore the possibility of using the computer to conduct instructional programs in an attempt to relieve teachers of the burden created while conducting individualized programs (Anglin & DeVault, 1974); since, as Suppes (1966) pointed out, the computer is capable of responding to most, if not all, of the individual differences of students.

The digital computer, within Computer-Managed Instruction (CMI), with its lightning speed and its reliability, has been carrying out clerical burdens associated with test administration, scoring and other related duties thus alleviating the instructors from those tasks and allowing them

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*This paper is based on the dissertation submitted by the same author to the Program of Instructional Design and Development of the Florida State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy. This dissertation, entitled An Assessment of Feedback Procedures and Information Provided to Instructors within Computer Managed Learning Environments, will be available through University microfilms after June 1978.

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more time for the necessary personal interaction with their students. Within that context, Gallagher (1970) stated that CMI attempts to maximize the computer's ability in diagnosing and prescribing in individualized instruction settings.

Various CMI systems, conceptualized within some prominent individualized instruction projects, have demonstrated CMI feasibility and effectiveness, e.g., Individually Prescribed Instruction (Cooley & Glaser, 1969), Program for Learning in Accordance with Needs (Flanagan, 1962, 1967), the Navy CMI System (Hansen, Poss, Bowman, & Thurmond, 1975), Instructional Management System (Coulson, 1971), Educational Management Information System (Schure, 1967), and others.

The advances in computer technology have been such that systems must be continually evaluated and revised, since technological-based systems must undergo repeated cycling between research and ongoing operations. It is pertinent to bring about the Hansen et al. (1975) assertion that the research and development activities act as stimulus to further fine-tune the CMI systems. In the document entitled Navy Computer-Managed Instruction: Past, Present, and Future, Hansen et al. (1975) reported that too much emphasis has been placed on the empirical development of CMI training programs and not enough on assessment of feedback.

The feedback report to the instructor, which is a CMI component, is an instrument that consists of hard data outputted by a computer system under a CMI strategy for instructor's use in guiding and monitoring students into individualized learning activities, in accordance with their past achievement and present needs. Instructor's actions toward the students and instructional materials should be a consequence of the information provided to him by the feedback report generated by the computer

system. It is, therefore, expected that such information should be coherent, relevant, useful, and meaningful to such actions.

A consistent body of research is reported in the literature in relation to feedback to the student within learning environments, but few research studies could be found regarding the area of feedback to the instructor.

Few questions have been raised so far regarding the educational implications of feedback reports to instructors outputted by CMI systems. Only two studies, one by Anglin & DeVault (1974) and the other by Hansen et al. (1975), have presented concerns about the utility of the hard information provided to instructors by CMI systems; while not one research study has been carried out using a population directly involved with the instrument named "Feedback Report to the Instructor."

Through the improvement of the CMI component named feedback report to the instructor it is expected to contribute to the overall improvement of CMI systems and the associated teaching-learning processes, since changes in one part of the system impact all other parts of the system (Houston, Howsam, Cooper, & Weber, 1974).

Statement of the Problem

Computer-Managed Instruction systems are designed to provide instructors, on a continual basis, with the feedback information required for their instructional decisions. Different CMI systems provide different information in content and format to instructors, consequently generating instructors' actions at various degrees of effectiveness and efficiency within their own educational environments. Therefore, research should be conducted to assess the gap between what this information currently is,

and what it should be. The purpose of this study was to critically assess the procedures and information provided to instructors by means of hard feedback reports outputted by computer-based student assessment systems. Specifically, this investigation attempted to assess the following factors related to feedback reports to instructors: (a) Information provided by the instrument, (b) Instrument's format, (c) Instructors' actions as a result of instrument's usage, and (d) Methods to facilitate instrument's usage.

Investigatory Questions

The following are the specific questions which this investigation attempted to answer:

1. What information is presented by the feedback report to the instructor?

2. What information should be presented by the feedback report to the instructor?

3. In what format is this information presented?

4. In what format should the information be presented?

5. How does the instructor use this feedback? What does he/she do as a result of receiving it?

6. How should the instructor use the feedback report?

7. What methods are used to facilitate instructors' effective use of feedback reports?

8. What methods should be used to facilitate instructors' effective use of feedback reports?

Additional Investigatory Questions

9. Relationship between faculty members' characteristics, e.g., academic status, academic experience, experience with computers, and

actual involvement with CMI learning strategies?

10. Relationship between discipline of faculty members and actual involvement with CMI learning environments?

This study was designed to provide the basis for the design of a feedback report to instructors that would contribute to the overall improvement of CMI systems and to offer positive results for the improvement of the teaching-learning processes associated with CMI learning environments.

METHODOLOGY

Subjects

Forty-four subjects were asked to participate in the study on a non-random selection basis. These subjects were faculty members at either the Florida State University or the University of Florida. One group of subjects consisted of 34 instructors who were using the Assessment Resource System at the Florida State University. Faculty members conforming this group came from seven academic department, namely: Biological Sciences, Economics, Interior Design, Instructional Communication, Mathematics, Physics, and Statistics. The other group consisted of 10 faculty members from the College of Dentistry, Department of Dental Education, who were using the PLATO System at the University of Florida. Special purpose questionnaires were administered to the total group of subjects obtaining a response rate of 54.5%.

Procedures

The educational system planning phase of a system approach conceptualized by Kaufman (1972, 1976a) was applied in the study, along with

alpha type needs assessment procedures (Kaufman, 1972, 1976a, 1976b). The educational system planning phase of Kaufman's Educational Systems Analysis model, includes the following steps: (a) Identify Problems from Needs, and (b) Determine Solution Requirements and Solution Alternatives (Kaufman, 1972, 1976a). The educational planning phase, which includes alpha type needs assessment and system analysis as planning tools, is concerned with "what" of the overall design-process model (Kaufman, 1972).

Kaufman (1976b) defined alpha type needs assessment as the determination of the gaps between current outcomes and required or desired outcomes based upon an additional referent of external survival and contribution, reconciles differences among the educational partners, and places the needs (outcome gaps) in priority for intended actions. The system analysis process, a key tool used in this problem-solving process, is designed to determine the feasible "whats" for system planning and design by analyzing requirements and identifying possible alternatives in successive levels of increasing detail (Kaufman, 1972).

Based upon the previously described educational system planning phase of Kaufman's model, this study attempted (a) to assess the gap between "what is" and "what should be" in relation to procedures and information provided to instructors by means of feedback reports generated by CPI systems, and (b) to design a different or alternative feedback report to instructors.

Two sources of information were available as a basis to accomplish the assessment:

1. Information gathered as a result of administering specially designed questionnaires to 44 faculty members who were currently deliver-

ing instruction using a CMI strategy within their own institutions.

2. Information gathered as a result of a request letter sent to 115 institutions using computers to support instructional and student assessment efforts. This information consisted of samples of feedback reports to instructors generated by various CMI systems.

The Research Task

The task involved in this study was analyzed using system approach techniques. System approach models include a series of interrelated and sequential components with provision for continuous feedback among them, conforming a coherent whole aimed toward the efficient solutions of educational tasks. Within this study a series of interrelated and sequential components were identified, which, in turn, determined the operational flow followed during its accomplishment. The sequenced block diagram of the research study is presented in Figure 1.

Instruments

Two specially designed questionnaires were developed to assess the gap between current and desired outcomes in relation to the factors of feedback reports to instructors stated in the investigatory questions. Sections within the questionnaires were developed to evaluate the factors associated with the additional investigatory questions. The following sections were considered within the questionnaires: (a) Subject's personal data, (b) Course information, (c) Informational content of feedback report to instructor, (d) Format of feedback report to instructor, (e) Instructor's actions as a result of receiving the feedback report to the instructor, (f) Methods to facilitate the use of feedback reports to instructors, and (g) Open-end questions.

Figure 1. Block diagram of research task.

The development of the questionnaires included a formative evaluation process. The internal review within the formative evaluation process was accomplished with the assistance of the following professionals: (a) The Director of the Assessment Resource System at the Florida State University, (b) An instructional designer, faculty member associated with the development and use of CMI systems and Director of Evaluation Services

at the Florida State University, and (c) two faculty members currently using the Assessment Resource System at FSU.

The external review within the formative evaluation process consisted of a pilot test which included two faculty members currently using the Assessment Resource System at the Florida State University. After completion of the formative evaluation process, internal and external review, final versions of the two questionnaires were ready for field administration and study implementation.

The questionnaires were field distributed and collected with the assistance of the department heads of the collaborating academic departments at the Florida State University and the University of Florida. Questionnaire 1 and 2 were distributed at random among the 44 faculty members. Twenty-four completed questionnaires were received divided as follows: Questionnaire 1 = 12; Questionnaire 2 = 12. The response rate from the subjects was equal to 54.5%.

Materials

The materials for this study were collected as a result of a survey letter sent to 115 institutions using computers to support instructional and student assessment efforts. A follow-up letter was sent later on to some institutions in order to insure an appropriate overall response rate. A 39.1% response rate was obtained since 45 institutions answered to the request letter. The actual response rate exceeded the expected response rate which had been estimated to be 35%.

The responses received from the 45 systems consisted of answer letters, technical papers, systems' brochures, various types of sample reports to the instructor.

DATA GATHERING

Two sources of information were used as a basis for the accomplishment of the assessment proposed in this study. These sources were as follows: (1) Data collected through the administration of two specially designed questionnaires to 44 subjects using the computer in student evaluation, and (2) sample feedback reports to instructors received as a result of a survey letter sent to 115 institutions using the computer in student evaluation.

As it was previously indicated, there were two sets of questionnaires which were administered at random to the 44 subjects. Twenty-four completed questionnaires were received and divided as follows: Questionnaire 1 = 12; Questionnaire 2 = 12. Each questionnaire contained six sections and among them three sections were identical and three were designed to assess different factors. Accordingly, this breakdown determined that 24 subjects were potential respondents to the sections on Subjects' personal data, Information about courses using the computer assessment system, and Open-end questions; and 12 subjects responded to the remaining sections of the questionnaires.

The second source of information consisted of samples of feedback reports to instructors and other materials received from 45 computer-based student assessment systems.

Based on pre-established procedures, both sources of information were classified, tabulated, and analyzed, and the results are reported in the remainder section of this paper.

Restatement of Problem Based on Alpha Needs Assessment

The sequenced block diagram of the research study was presented in Figure 1; step 9.0 included the restatement of the problem based on alpha type needs assessment. As it was indicated earlier in this paper, Kaufman (1976b) defined alpha type needs assessment as the determination of the gaps between current outcomes and required outcomes based on an additional referent of external survival and contribution, reconciliation of differences among the educational partners, and the placement of needs in priority for intended actions. Based on Kaufman's model (1972, 1976a, 1976b), the problem is restated below for each of the educational partners, i.e., the learner, the instructor, and society.

[redacted]

SUMMARY AND RECOMMENDATIONS

In an introductory section of this paper it was expressed that different computer-managed instruction systems provided different feedback information in context and format to instructors, which generated instructors' actions at various degrees of effectiveness and efficiency within their own educational environments. It was also expressed that a research study should be conducted to assess the gap between "what this information currently is and what it should be." This research study was proposed to critically assess the procedures and information provided to instructors by means of hard feedback reports generated by computer-based student assessment systems, in order to determine current usefulness and meaningfulness to users and to present the design of a different or alternative instructor's feedback instrument. A review of the literature supported the research herein proposed, since it was found that (a) limited research studies had been accomplished in relation to the area of feedback to the instructor, (b) few questions had been raised regarding the educational implications of feedback reports to the instructors outputted by computer-managed instruction systems, (c) not one research study had been carried out using a population directly involved with the instrument named "feedback report to the instructor."

Specifically, this investigation was focused toward the assessment of the following factors related to instructors' feedback reports: (a) Information provided to instructors by the feedback instruments, (b) Instrument's format, (c) Instructor's actions as a result of instrument's usage, and (d) Methods to facilitate instrument's usage. The following were the specific investigatory questions that this investigation attempted to answer:

1. What information is presented by the feedback report to the instructor?
2. What information should be presented by the feedback report to the instructor?
3. In what format is this information presented?
4. In what format should the information be presented?
5. How does the instructor use this feedback? What does he/she do as a result of receiving it?
6. How should the instructor use the feedback report?
7. What methods are used to facilitate instructors to effectively use feedback reports?
8. What methods should be used to facilitate instructors to effectively use feedback reports?
9. Relationship between faculty members' characteristics, e.g., academic status, academic experience, experience with computers, and actual involvement with CMI learning strategies?
10. Relationship between discipline of faculty members and actual involvement with CMI learning environments?

The educational system planning phase of a systems approach, as conceptualized by Kaufman (1972, 1976a), and alpha type needs assessment procedures (Kaufman, 1972, 1976a, 1976b) were applied to carry out the proposed study. Two sources of information were available as a basis to accomplish the study:

1. Information gathered as a result of administering two specifically designed questionnaires to 44 faculty members who were delivering

instruction using computer-managed instruction strategies at the Florida State University and at the University of Florida.

2. Technical information and sample instructors' feedback reports gathered as a result of a request letter sent of 115 institutions that were using computers to support instructional and student assessment efforts.

Informational Content of Feedback Reports to Instructors

The input data provided by the two sources of information available for the study established the framework for the discrepancy analysis of the informational content of instructors' feedback reports. The result of the combined assessment data is presented below and consists of an ideal set of information items for a computer-generated feedback report to the instructor.

Identification Data

The following information items were recommended to be included as part of the identification data within feedback reports to instructors:

Name of institution

Report title

Academic term

Date and time of report

Course name and number

Class section identification

Name of the instructor

Students identification by name and I.D. number

Performance Data

The following information items were recommended to conform to the body of information about each student performance data within feedback

reports to instructors:

Identification of instructional units

Identification of instructional objectives

Objectives mastered

Objectives not mastered

Each student's score on each objective within a test

Highest test score earned by each student on each unit test

Each student cumulative score in course as of report's date

Minimum cumulative score for each course letter grade

The informational items indicated below, although not ranked high by subjects, were included based on this investigator's experience with CMI systems and the careful observation and assessment of the available technical information and sample feedback reports:

Indication of total number of instructional units within the course

Number of objectives in each instructional unit

Minimum score required to pass each unit test

Mean and standard deviation (each student's cumulative score)

Instructions for report's use

This set of ideal feedback information items generated a unique feedback report to the instructor that could be represented by the name of "Cumulative class progress report." This is a type of report intended to provide individual achievement information about the students enrolled in a course or course-section on two or more units of instruction. This report delivered on a weekly basis should provide instructors with a body of useful, meaningful, and coherent feedback information for the accomplishment of their instructional responsibilities.

According to the responses received through the questionnaires' open-end questions, physically obtaining the reports appeared to be of difficulty for instructors. This result indicated that delivery procedures of instructors' feedback reports should be seriously established and carried out by CMI personnel.

Item analysis reports, either at completion of each instructional unit or at the end of the academic term, were reported by instructors as useful and were predominant type of reports among respondent CMI systems.

Format of Feedback Reports to Instructors

Within this study it was found that the informational content of instructors' feedback reports had been presented using a coherent and meaningful format. Even though feedback reports' format was not identified as a problem area by respondents, it should be a factor of important consideration in the redesign or development of new computer-managed instruction systems. Figure 2 presents an example of how informational content of instructors' feedback reports should be displayed.

Instructors' Actions as a Result of Receiving Instructors' Feedback Reports*

The discrepancy data on instructors' actions indicated that the provided feedback information from computer-based student assessment systems

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*Instructors' actions as a result of receiving instructors' feedback reports were listed as follows: Guide individual students experiencing learning difficulties, Guide groups of students experiencing similar learning difficulties, Identify who are behind the group, Identify who are ahead of the group, Work with the class as a whole, Improve instructional materials used inside the classroom, Improve supporting instructional resources used outside the classroom, Improve test items, Peschedule amount of time spent with various units of instruction, Peduce or increase instructional materials and/or assignments available to students.

Name of Institution
Report Title

Course name and number | Class section | Academic Term | Instructor's name | Date and time of report

Indication of total # of instructional units in course:	Grading system or minimum cumulative score for each course letter grade:	Instruction for report's use: i.e., x = objective mastered o = objective not mastered

Student's names	I.D. numbers	Unit #	# objectives in unit	Unit Minimum passing score	Objectives identification 1 1 1 1 1 1 1 1 1 1 2 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0	Student highest score in unit	Student cumulative score to date	Student grade
___,___	___-___-___	1	8	___	x x x x o x x	___	___	___
___,___	___-___-___	1	8	___	x x o x x x o o	___	___	___
		2	10	___	x x x x x x o o o o	___		
___,___	___-___-___	1	8	___	x x x o x x x x	___	___	___
		2	10	___	x x x x x x x o o o	___		
		3	12	___	x x x x x x x x x x x x	___		
		4	6	___	x x x o o o	___		
___,___	___-___-___	1	8	___	x x x x x x x x	___	___	___
etc.								

Mean (student cumulative scores) •

Standard deviation •

Figure 2. Informational content and format of feedback report to instructor.

enabled them to accomplish 20% of their instructional responsibilities. It is realized that university faculty are autonomous in their classroom activities and that they cannot be forced to adopt instructional innovations. But, it is also realized that if faculty who are using computer-managed instruction strategies are not provided with useful and meaningful information, they will not be able to effectively accomplish their instructional responsibilities. Traditional instruction on one hand, and instruction delivered with the assistance of CMI strategies on the other, imply different instructor behavior. Difference in behavior is due primarily to the provision of hard feedback information from the computer system.

The implementation of adequate feedback information, appropriate delivery procedures of feedback reports, and consistent training activities should enable instructors to fully accomplish their specific instructional responsibilities of students' guidance, improvement of instructional materials and resources, test items, rescheduling of instructional activities, and other related tasks. As a consequence, instructors' behavior change and a greater acceptance of more innovative instructional approaches will take place as a natural law of effect.

Methods to Facilitate the Use of Feedback Reports to Instructors

Data indicated that subjects considered important all suggested areas of training for instructors using feedback information from computer-based student assessment systems.* The results yielded also that printed mate-

*Areas of training for instructors using feedback information from computer-based student assessment systems were listed as follows: Accurate interpretation of instructor's feedback reports, Appropriate use of the information contained in instructor's feedback reports, Development of instructional materials/exercises to remediate student's difficulties, Identification of strategies for improving student's use of test feedback, Improving test item quality, Interpretation of item analysis.

rials appeared to be the most beneficial method of presentation for the suggested training areas, individual consultation being the second one. Specific consideration should be given to the development of a CMI system user manual, including the following segments: (a) Purpose and features of the system, (b) System's operational procedures, (c) Purpose and meaning of information items within reports to instructors, (d) Purpose and meaning of information items within feedback reports to students, (e) Relationship between instructors' and students' feedback information through a "support document," (f) Guidelines for the development and improvement of instructional materials and resources, (g) Guidelines for interpretation of item analysis, (h) Guidelines for the improvement of test item quality.

Relationship Between Faculty Members' Characteristics and Actual Involvement with CMI Learning Strategies

The subjects' personal data indicated that the academic status of instructors using CMI learning strategies ranged from graduate assistants to full professors. Their academic experience at the university level averaged 5.8 years, and the average number of years they have been associated with the use of the computer as a support of instruction equaled 2.7 years.

Relationship Between Discipline of Faculty Members and Actual Involvement with CMI Learning Environments

It was found that computer-managed instruction strategies were being used within the universities mostly at the undergraduate level. Subjects reported 12 courses as being undergraduate level courses, and only one as being graduate level course. Within this study, it was found that CMI environments were applied in courses within academic department such as:

Biological Sciences, Dental Education, Economics, Interior Design, Instructional Communication, Mathematics, Physics, and Statistics. The technical information furnished by various respondent systems indicated the use of CMI strategies in courses such as: Computer technology, General psychology, Precision measurement equipment, Resources Management, Weapon mechanisms, and many others.

Implications of the Assessment Study

This study was accomplished to critically assess feedback procedures and information provided to instructors within computer-managed learning environments. As a result of the study it has been determined a useful and relevant informational content that should be included in instructors' feedback reports, as well as the meaningful and coherent format that should be presented to instructors using CMI strategies. Specific training areas for instructors using feedback information from computer-based student assessment systems, and the most beneficial presentation methods for the same which should be developed and implemented, are suggested. To avoid troublesome situations created by inappropriate delivery procedures, mechanisms should be implemented so that the feedback report to the instructor could be automatically put in the hands of the user.

CMI will continue to be effective for student assessment, but redesigning the computer software to meet new procedures and informational content should make CMI systems more efficient for student assessment and even better for program evaluation. The computer should move from a mere testing tool to a true device for the management of the educational process. Traditional teaching modes should be replaced for more advanced and efficient instruction presentation methods. Instructors should be proud to engage

in the use of computer-managed learning strategies, and should be able to fully and efficiently accomplish their instructional responsibilities.

Implications for Future Research

The redesign of computer software within CMI systems to meet the new format and informational content requirements, the implementation of the suggested training activities using the most beneficial presentation methods, the establishment of CMI user manuals, and the implementation of appropriate and effective mechanisms for the delivery of instructors' feedback reports should positively impact the teaching-learning processes associated with computer-managed learning environments. Instructional materials and resources should be improved and interaction process between the learner and the instructor should be facilitated and enriched. As a consequence, the learner, center of the educational process, should certainly obtain the major benefits. Research should be conceptualized and conducted to verify student achievement gain and attitude change under the new conditions as compared to current procedures and information within computer-managed learning environments.

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